Khadanza pavements with FaL-G Bricks and blocks offer rural roads under Prime Minister's Grameen Sadak Yojana, with at least 100-years guarantee.

FaL-G for Infrastructure Applications

The clay brick of yesteryears has been produced out of very fertile soil with absolute water repellence and strengths in the order of 150-200 kg/cm^2. Earlier to the advent of OPC into construction arena with its history of 175 years, sintered clay products used to be the popular structural media. Canal linings and *khadanza* roads are some popular infrastructure avenues where the quality of bricks used to be aptly tapped to serve the technical requirements.

With deterioration in quality of clay, undue reduction in sintering practices (on account of spiralling fuel costs) and fall in production standards, use of brick in infrastructure applications is avoided dominated by cement-concrete simultaneously.

FaL-G is poised to revive this trend with its superior technical virtues and modest cost factors. Opening up such applicational avenue creates market for hundreds of billions of bricks summoning for additional production capacities in huge quantities, notwithstanding its demand in housing sector.

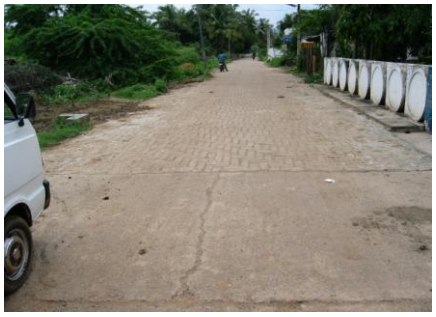
95 Years-old Khadanza in UP With clay bricks

'Khadanza' Pavements with FaL-G

With rapid urbanisation, the need for more and more rigid pavements is gaining importance. However, monetary constraints of exchequer do not permit the execution of expensive rigid pavements with concrete. Flexible pavements with bitumen, though proved to be relatively cheaper to concrete, are observed to be more expensive in long run on account of vulnerability against rain (water) and recurring cost of their maintenance. It is in this background, *khadanza* pavements with FaL-G bricks are going to offer as viable alternate to the exchequer.

The country is going to be flooded with fly ash in view of more and more thermal plants in the pipeline. Urgent steps need to be taken for regulation and mass scale utilisation of fly ash. Fly ash generation at 200 million tpa as of now and about 270 million tpa by the turn of the decade (2020) is a colossal quantity to be taken care in the present day context of 20-30% utilisation. Brick production is considered as a massive avenue of fly ash utilisation on account of techno-

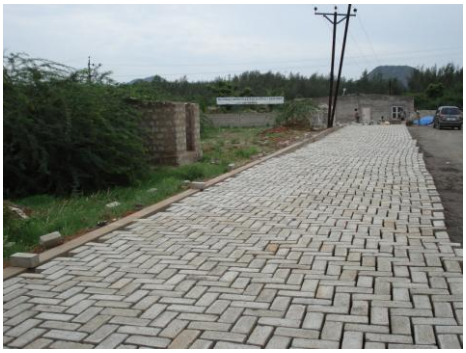
economic feasibilities of FaL-G technology. It is more sensible to tap high strengths of FaL-G bricks for infrastructure applications. In this context, revival of *khadanza* pavements with FaL-G bricks is not only a viable proposition to the exchequer for laying durable pavements but also contributes for mass scale fly ash utilisation which is another factor of equal importance to the country.



Khadanza laid with FaL-G blocks in 1994.

To prove it in the field, INSWAREB Building Centre has laid khadanza pavement in 1994 with FaL-G bricks on trial basis at Sheelanagar, Visakhapatnam, an area laden with black cotton soil. This experimental road was funded by Housing & Urban Development Corporation (HUDCO) under R&D grant assistance.

Another stretch of pavement was executed at the entry of INSWAREB Building Centre, Paravada in 2009 getting exposed to traffic of incoming and outgoing vehicles that carry raw materials and finished products of the unit.



Khadanza pavement with FaL-G blocks executed in 2009 at INSWAREB Building Centre, Paravada Village, Visakhapatnam.

The design of 'khadanza' pavements involves the orientation of bricks in specific manner where the headers make a perpendicular angle with stretcher which, in turn, makes another right angle with header. The orientation continues in ascending or descending order till the last brick reaches the edge of the road.

No mortar joint will have a length more than the total of length and breadth of the brick. The joints are normally maintained with considerable width, say not less than 15 mm, to facilitate easy penetration of mortar slurry. The mortar slurry is filled through gravity feed than poking into the gaps. Thereby the mortar settles down in the gaps of bricks, if any, even at the bottom plane of placement in order to render better rigidity and absolute filling. Such orientation of joints is considered to make the pavement crack-free and more rigid. In view of high WCF required for slurrying, mortar is made of rich mix at 1:3.

Advantages

Khadanza pavements with FaL-G bricks offer the following advantages :

A. *Khadanza* work is convenient, as a substitute to concrete pavements, wherever the concrete mixers and vibrators are unavailable/inaccessible.

B. In places like bylanes and slum roads, where entry of road rollers is ruled out for constructing flexible pavements, *khadanza* can substitute concrete pavements easily.

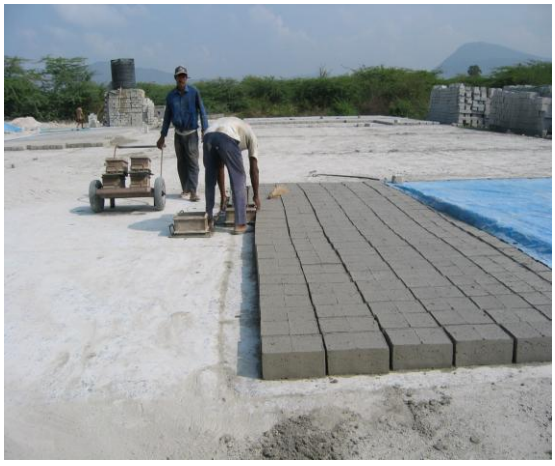
C. *Khadanza* road can be offered with its optimum strength right from the first day, as long as fully cured bricks are used, because the bricks do take the loads and hence these roads can be released for traffic relatively at early age.

D. The roads are crack-free and amenable for localised repair to the extent of damaged brick area.

E. No expansion joints are required because the expansion stresses are absorbed by mortar joints.

F. Khadanza pavement is cost effective by 40% over concrete pavement, with enhanced performance. In addition, cost of steel as dowels, screed bars etc., is saved further.

G. FaL-G bricks and blocks can be manufactured at village level deploying local labour creating enormous rural employment. The plant and machinery are very simple at a cost of Rs. 5.50 lakhs.



FaL-G block production in a simple plant of Rs. 5.50 lakhs that can manufacture over 10 cu.m of blocks per shift.

Cost comparison (Budgetary):

Budget Estimate for 3.75 mtr x 1 km khadanza pavement with FaL-G blocks:

Excavation of earth: 0.15 m x 3.75 m x 1000 m

Soling: 0.20 m x 3.75 m x 1000 m with boulders, granite, stone dust and fly ash, duly watered and compacted with Vibratory roller.

Pavement: 0.15 m height with Khadanza blocks of size 31.5*15*15 cm, joints filled with FaL-G mortar of M-20 grade; and kerbs finished with M-30 FaL-G concrete.

Excavation of earth:		1000	3.75	0.15	563	450	253,125
Soling: boulders+		1000	3.75	0.2	750	800	600,000
40 mm+ CD+Fa							
Compaction				sq.mtr	3750		10,000
Vib.Roller : 2500/day							
Total cost of sub-base:							863,125
Pavement: sq.mtr		1000	3.75	sq.mtr	3750	617.25	2,314,688
Bricks:31.5*15*15 cm							
per cu.m.							
Masons & Labour:		30%					694,406
Ultimate cost:							**3,872,219**
Comparative cost of concrete:							
Cost of sub-base as above							863,125
Cost of M30 Concrete	cu.m					5,500	
Pavement volume		1000	3.75	0.15	563		
Total cost of concrete							3,093,750
Nominal reinforcement	kg/sq.m		2		7500	45	337,500
Laying & Finishing		30%					928,125
							5,222,500

Note:

1. Sub-base preparation cost of Rs. 8.63 lakhs is common for both concrete and khadanza pavement. Then the cost comparison comes to 30.09 for khadanza against 43.59 for concrete, where the former can be guaranteed for 100 years.

2. There is a chance to conserve on Budget for excavation, depending on the soil condition and working factors.

3. The soling envisaged is better than the Departmental design, as the soling is designed to use fly ash as additional input for better compaction, stability and improved engineering properties.

4. There is a chance to save on masons and labour cost depending on local logistics.

Khadanza pattern: